



LM-79-08 Test Report

for

P.Q.L., Inc.

2285 Ward Avenue / Simi Valley, CA 93065

LED Tube

Model: 91420

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070021b

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Review by:

Engineer: April Zou
Sep. 18, 2018



Approved by:

Manager: Jim Zhang
Sep. 18, 2018

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Test Summary

| | |
|---|--------------|
| Model | 91420 |
| Luminous Efficacy (Lumens /Watt) | 130.3 |
| Total Luminous Flux (Lumens) | 3624.3 |
| Power (Watts)/2 | 27.82 |
| Power Factor | 0.9984 |
| CCT (K) | 4979 |
| CRI | 82.4 |
| Stabilization Time (Light & Power) | 60 mins |
| Note | 5000K |

Table 1: Executive Data Summary

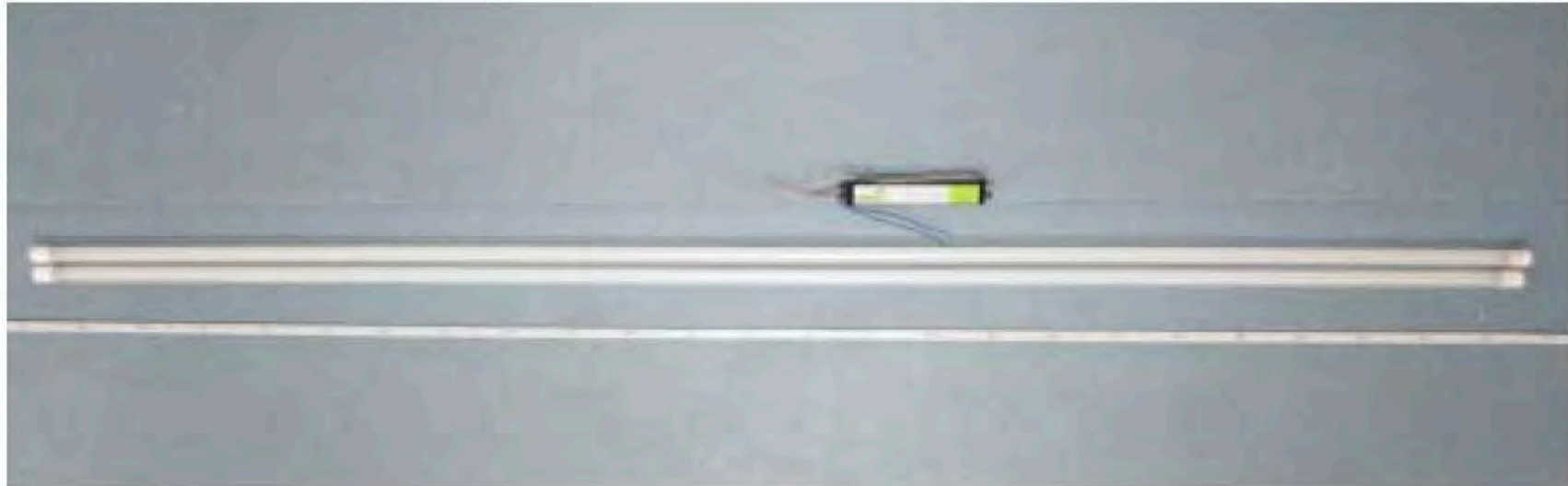
Test specifications:

| | |
|---------------------------|--|
| Date of Receipt | : Jul. 13, 2018 |
| Date of Test | : Jul. 24, 2018 |
| Test item | : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters |
| Reference Standard | : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products |

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Sample Photo



Sample view

Equipment Under Test (EUT)

| | |
|----------------------------|---|
| Name | : LED Tube |
| Model | : 91420 |
| Electrical Ratings | : 120-277V, 50/60Hz |
| Product Description | : Fa8 base, 5000K LED Tubes supplied by a high frequency fluorescent lamp ballast: EB-259IS-U |
| Manufacturer | : P.Q.L., Inc. |
| Address | : 2285 Ward Avenue / Simi Valley, CA 93065 |

TEST RESULTS

Test ambient temperature was 24.8°C.

Base orientation was light down. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

Sphere-Spectroradiometer Method

| Parameter | Result | |
|---------------------------------------|------------------|--------|
| | Test Voltage (V) | 120.0 |
| Voltage frequency (Hz) | 60 | 60 |
| Test Current (A) | 0.465 | 0.203 |
| Power Factor | 0.9984 | 0.9814 |
| Test Power (W)/2 | 27.82 | 27.58 |
| THD A% | 5.30 | 9.29 |
| Luminous Efficacy (lm/W) | 130.3 | 131.3 |
| Total Luminous Flux (lm) | 3624.3 | 3620.4 |
| Color Rendering Index (CRI) | 82.4 | |
| R9 | 3.2 | |
| Correlated Color Temperature (CCT)(K) | 4979 | |
| Chromaticity Chroma x | 0.3466 | |
| Chromaticity Chroma y | 0.3620 | |
| Chromaticity Chroma u | 0.2084 | |
| Chromaticity Chroma v | 0.3266 | |
| Duv | 0.0045 | |
| Chromaticity Chroma u' | 0.2084 | |
| Chromaticity Chroma v' | 0.4899 | |

| Special Color Rendering Indices | |
|---------------------------------|------|
| R1 | 79.8 |
| R2 | 89.4 |
| R3 | 95.3 |
| R4 | 79.4 |
| R5 | 80.5 |
| R6 | 85.4 |
| R7 | 85.3 |
| R8 | 63.9 |
| R9 | 3.2 |
| R10 | 74.6 |
| R11 | 80.7 |
| R12 | 47.6 |
| R13 | 82.2 |
| R14 | 97.7 |

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

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Spectral Power Distribution - Sphere Spectroradiometer Method

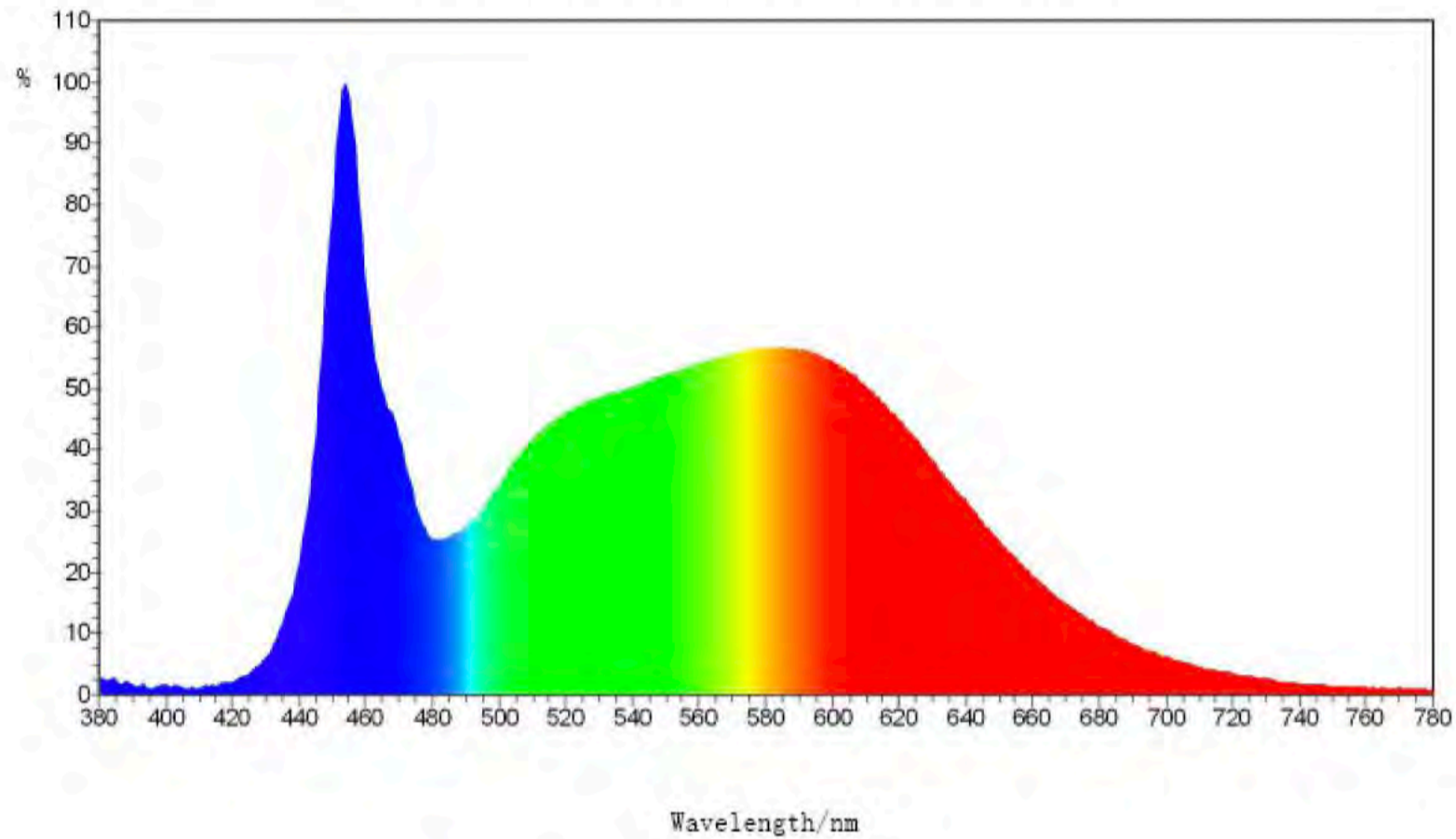
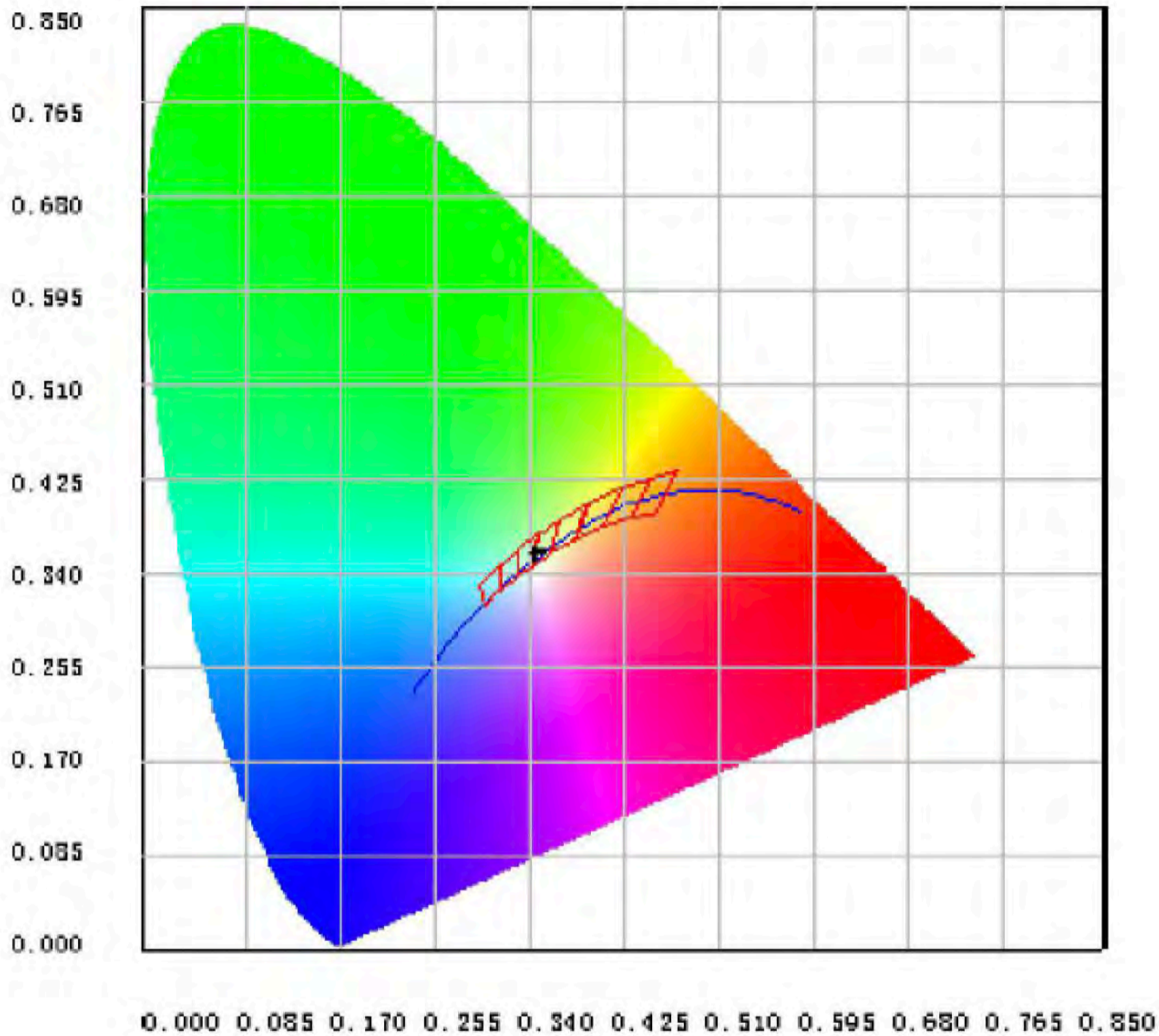


Chart 1: Spectral Power Distribution

| Spectral Distribution over Visible Wavelength | | | | | | | |
|---|----------------|--------|----------------|--------|----------------|--------|----------------|
| WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) | WL(nm) | Radiant(Watts) |
| 380 | 3.15E-03 | 485 | 2.87E-02 | 590 | 6.25E-02 | 695 | 8.09E-03 |
| 385 | 2.94E-03 | 490 | 3.06E-02 | 595 | 6.19E-02 | 700 | 7.04E-03 |
| 390 | 1.91E-03 | 495 | 3.34E-02 | 600 | 6.05E-02 | 705 | 6.03E-03 |
| 395 | 1.16E-03 | 500 | 3.80E-02 | 605 | 5.86E-02 | 710 | 5.20E-03 |
| 400 | 1.85E-03 | 505 | 4.26E-02 | 610 | 5.61E-02 | 715 | 4.56E-03 |
| 405 | 1.53E-03 | 510 | 4.62E-02 | 615 | 5.32E-02 | 720 | 4.00E-03 |
| 410 | 1.24E-03 | 515 | 4.90E-02 | 620 | 5.00E-02 | 725 | 3.50E-03 |
| 415 | 1.74E-03 | 520 | 5.10E-02 | 625 | 4.64E-02 | 730 | 2.97E-03 |
| 420 | 2.32E-03 | 525 | 5.27E-02 | 630 | 4.27E-02 | 735 | 2.48E-03 |
| 425 | 3.94E-03 | 530 | 5.39E-02 | 635 | 3.88E-02 | 740 | 2.12E-03 |
| 430 | 6.92E-03 | 535 | 5.48E-02 | 640 | 3.52E-02 | 745 | 2.00E-03 |
| 435 | 1.31E-02 | 540 | 5.60E-02 | 645 | 3.15E-02 | 750 | 1.72E-03 |
| 440 | 2.41E-02 | 545 | 5.70E-02 | 650 | 2.79E-02 | 755 | 1.50E-03 |
| 445 | 4.74E-02 | 550 | 5.79E-02 | 655 | 2.49E-02 | 760 | 1.46E-03 |
| 450 | 9.04E-02 | 555 | 5.89E-02 | 660 | 2.19E-02 | 765 | 1.36E-03 |
| 455 | 1.08E-01 | 560 | 6.00E-02 | 665 | 1.91E-02 | 770 | 1.47E-03 |
| 460 | 7.68E-02 | 565 | 6.09E-02 | 670 | 1.68E-02 | 775 | 1.14E-03 |
| 465 | 5.59E-02 | 570 | 6.20E-02 | 675 | 1.46E-02 | 780 | 1.05E-03 |
| 470 | 4.70E-02 | 575 | 6.26E-02 | 680 | 1.26E-02 | | |
| 475 | 3.45E-02 | 580 | 6.29E-02 | 685 | 1.08E-02 | | |
| 480 | 2.84E-02 | 585 | 6.31E-02 | 690 | 9.43E-03 | | |

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3466, 0.3620)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

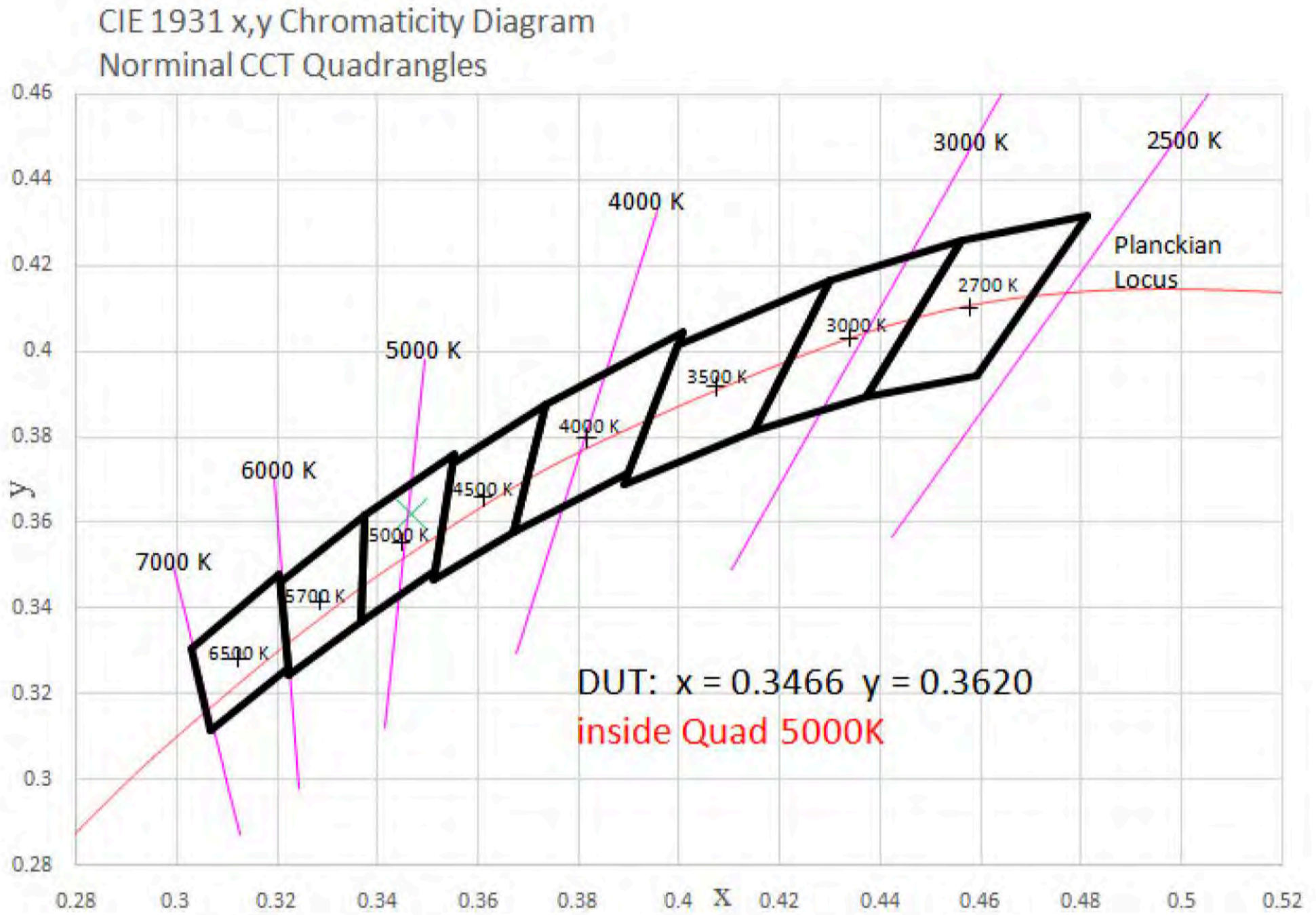


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

EQUIPMENT LIST

| Test Equipment | Model | Equipment No. | Calibration Date | Calibration Due date |
|-----------------------------------|----------|---------------|------------------|----------------------|
| Integrate Sphere system | 3M | HZTE015-04 | Apr. 27, 2018 | Apr. 26, 2019 |
| Digital Power Meter | WT210 | HZTE008-01 | Aug. 10, 2017 | Aug. 09, 2018 |
| AC Power Supply | PCR 500L | HZTE001-07 | Aug. 10, 2017 | Aug. 09, 2018 |
| DC Power Supply | IT6154 | HZTE004-04 | Aug. 10, 2017 | Aug. 09, 2018 |
| Temperature and humidity recorder | JR900 | HZTE018-02 | Aug. 16, 2017 | Aug. 15, 2018 |
| Standard source | SCL-1400 | HZTE012-02 | Aug. 20, 2017 | Aug. 19, 2018 |
| Temperature Meter | TES1310 | HZTE017-01 | Aug. 17, 2017 | Aug. 16, 2018 |

Table 4: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 2.1% with a coverage factor $k=2$.

*** End of Report ***

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